Armed Forces College of Medicine

AFCM

Upper vs Lower Motor Neuron Lesions

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INTENDED LEARNING OBJECTIVES (ILOs)

By the end of this lecture the student will be able to:

1. Describe upper and lower motor neuron
2. Compare upper and lower motor neuron lesions
3. Explain babinski’s sign
4. Explain clonus
5. Explain lengthening reaction (clasp knife)

Upper Motor Neurons (UMNs)

Neurons in cerebral cortex and brain stem that activate lower motor neurons. Their axons form the descending motor pathways.

- **Head muscles** are supplied by neurons of **CMAs** and their axons (**CBT) & (CNT)**.
- **Body muscles** are supplied by neurons of **CMAs** and their axons **(CST)**

+ **Extrapyramidal tracts**.

Spinal cord **& motor neurons** receive inputs from: **Corticospinal T.**

Lower Motor Neurons (LMNs)

- **Spinal** and **cranial** motor neurons that directly innervate skeletal muscles.

- Movement of **head muscles: Cranial motor** nuclei &

cranial motor nerves.

- Movement of **Body muscles: Spinal motor** neurons &

peripheral motor nerves.

So **UMNL** or **LMNL** → loss of both fine and gross movements **(Paralysis).**

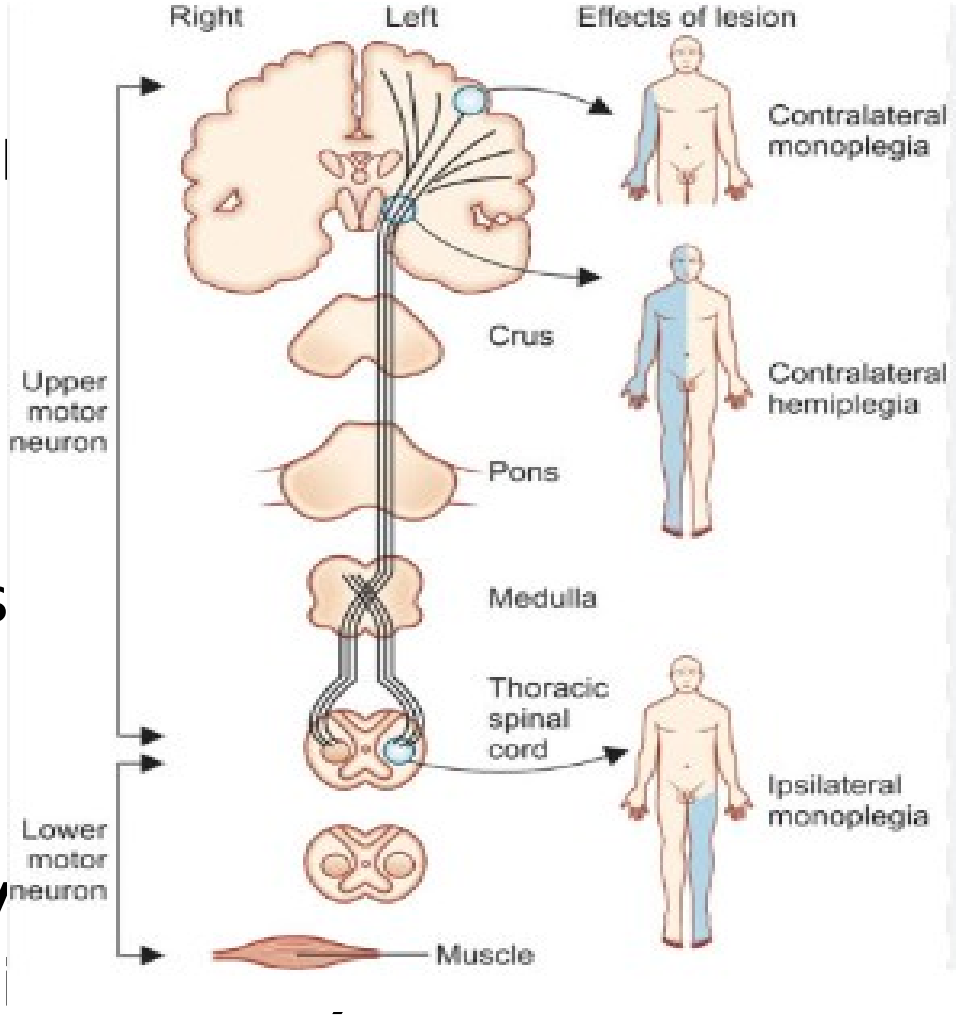
Upper Motor Neuron Lesion (UMNL)

Definition:
Damage of CMAs or descending motor t
(pyramidal & extrapyramidal).

Sites:

1. CMAs (not common) →
Contralateral monoplegia (extensive repres
2.Posterior limb of internal capsule →
Contralateral hemiplegia.
3. Brain stem →
Contralateral hemiplegia (+ ipsilateral LM
motor cran

4.Spinal cord →
Ipsilateral affection (The **only** site causing ipsilateral UMNL affection).



https://www.jaypeedigital.com/book/9789351522171/chapter/ch2

Upper Motor Neuron Lesion (UMNL)

Lesion in **posterior limb of internal capsule:**

Cause: vascular due to hemorrhage or thrombosis of **Lenticulo-striate artery.**

Stages of UMNL

1- Acute stage

(Immediate Effects = Cerebral Stroke)

2- Chronic stage

(Spastic paralysis = Permanent UMNL)

Upper Motor Neuron Lesion (UMNL)

Acute stage: (Immediate Effects = Cerebral Stroke) for 2-6 weeks

1.Contralateral hemiplegia: Flaccid paralysis affecting **contralateral:**

upper limbs, lower limbs, lower facial muscles and half of tongue.

2.Contralateral hemianesthesia.

3.Loss of superficial reflexes.

4.Hypotonia (Flaccidity) **and areflexia:** due to loss of

Upper Motor Neuron Lesion (UMNL)

Chronic stage: (Spastic paralysis = Permanent UMNL)

A) Sensory Disturbances:

1. Recovery of **crude** sensations: but fine sensations never recover.
2. Contralateral homonymous Hemianopia.
3. Decreased Auditory Acuity: But not complete deafness. (Bilaterally represented)

Upper Motor Neuron Lesion (UMNL)

B) Motor Disturbances:

1. Muscle spindle reflex increased activity: Due to ↓ activity of **inhibitory (Medullary) reticular area** and ↑ activity of **excitatory (Pontine) reticular area→**

a. Hypertonia (spasticity): in antigravity muscles (UL flexors & LL extensors)

b. Hyperreflexia. Exaggerated tendon jerks.

c. Clonus:

e.g. Ankle clonus: It is contraction-relaxation of calf muscles due to:

→ repeated m. spindle discharge → stretch-inverse stretch Reflex

Upper Motor Neuron Lesion (UMNL)

2. Slight recovery of gross movement: patient may walk due to:

a) Ipsiateral CST.

b) Extrapyramidal rubrospinal tract (lower than int. capsule).

But still there is loss of muscle power in voluntary acts.

3. Normal Muscle Bulk.

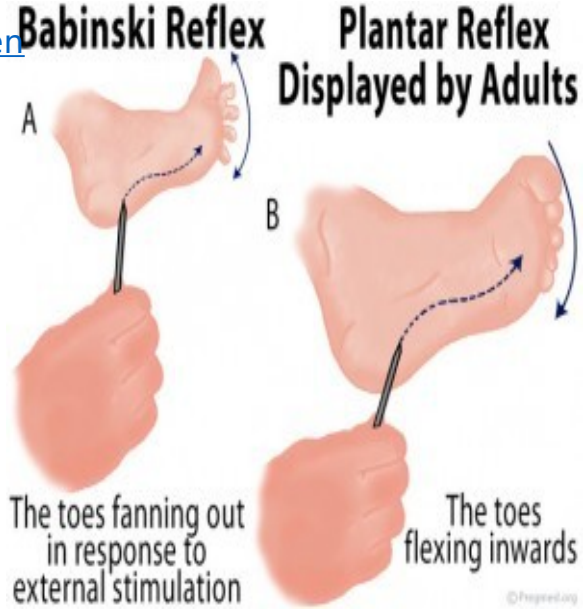
No immediate atrophy, as muscles are still innervated, contract reflexly.

4. Positive Babinski's sign.

Plantar response

- **Afferent :** Dorsal Root.
- **Center :** L5 – S1
- **Efferent :** Ventral Root

https://www.pregmed.org/baby-developmental-milestones/babinski-reflex



3 Possibilities

1-Normal planter response

(Planter flexion of toes)

2-Positive Babinski's sign (Dorsal flexion of big toe & fanning of outer 4 toes)

-U.M.N.L

3- Pseudo +ve Babinski's sign

-Deep sleep.

a)-Anesthesia .

b)-New born.

Lower Motor Neuron Lesion (LMNL)

Definition: It is lesion in spinal or cranial motor neurons or their axons.

Sites:

1. **Spinal cord** (damage of A.H.C.)
   e.g. Syringomyelia or Poliomyelitis (one limb).

2. Damage of **ventral Root**
   e.g. Traumatic spinal cord lesion.

3. Damage of **peripheral nerves**.
   e.g. alpha compression of median nerve at wrist or Polyneuritis.

4. Damage of **muscle**: as in Myasthenia Gravis.

LMNL	Chronic UMNL	
-Localized	-Widespread	**1. Definition:**
- Ipsilateral	-Contralateral	
- Paralysis of separate Ms.	- Paralysis of movement	
- lesion in motor neuron.	- due to lesion in tract	
Flaccid Paralysis	Spastic paralysis	**2. Character**
May recover	Never (no neurilemma)	**3. Recovery**
Immediate muscle atrophy → fibrous tissue	Disuse Atrophy on long term	**4. Muscle state**
Decreased (alpha damage)	Increased	**5. Muscle Tone**
lost	Lost	**6. Muscle power**
All are lost	All Lost except +ve Babinski	**7. Sup. Reflexes**
Hyporeflexia	Hypereflexia	**8. Deep Reflexes**
Present	Absent	**9. Reaction of denervation**
Absent	Present	**10. Clonus**

N.B. Acute UMNL is exactly the same as LMNL except in: Widespread, +ve Babinski, No Atrophy.

Reaction of Denervation:

Occurs at least **10 days of lesion.**
Occurs in the period between loss of nerve excitability and loss of muscle excitability.

It consists of:

1.Fasciculation:

Rhythmic regular contractions affecting **group of muscles**, **visible & palpable** due to spontaneous discharge from nerve roots.

2. Fibrillation:

Rhythmic contractions of **separate muscle fibers** **not** visible or palpable, increase by warmth, decrease by cold, recorded by EMG due to increased sensitivity to circulating Ac.ch.

Reaction of Denervation:

3. Abnormal response to electrical stimulation:

a) Normal response:

- Response to **Faradic** current > to **galvanic**
- **CCC** > ACC
- Cathodal closing cont. > Anodal closing cont.

b) Incomplete Reaction of Degeneration:

- **ACC** > CCC
- The muscle responds **only to galvanic**.

c) Complete R.D.

- Muscle completely degenerated.
- **No** response at all.

4. Loss of H. (Hoffman) reflex.

Lecture Quiz

1. Lower motor neuron lesion is characterized by which of the following?

A. Loss of voluntary movements but preservation of reflex movements.
B. A widespread disease.
C. Immediate atrophy of the voluntary muscles.
D. Exaggerated reflexes.
E. Hypertonia

Lecture Quiz

2. A Uni-lateral lesion in the internal capsule (chronic stage) results in which of the following:

a. Spastic paralysis on the contra-lateral side.
b. Flaccid paralysis on the contra-lateral side.
c. Flaccid paralysis on the ipsi-lateral side.
d. Loss of Babinski's sign.
e. Marked muscle atrophy.

Summary

-UMNs are neurons in cerebral cortex and brain stem that activate lower motor neurons.

-LMNs are spinal and cranial motor neurons that directly innervate skeletal muscles.

-UMNL is damage of descending motor tracts (From c.c. to A.H.C.) both Pyramidal + COEP.

-Manifestations of UMNL pass into 2 stages, acute and chronic stages.

-Babiniski sign is an anormal plantar response caused by UMNL.

SUGGESTED TEXTBOOKS

1. Ganong’s Review of Medical Physiology, twenty-fifth edition 2016, McGraw-Hill Education, chapter 12, from page 227 to 254

Thank You